UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/762,769	01/21/2004	Anastasios Melis	BERK-016CIP	3105

24353 7590 04/07/2006

BOZICEVIC, FIELD & FRANCIS LLP
1900 UNIVERSITY AVENUE
SUITE 200
EAST PALO ALTO, CA 94303

EXAMINER	
RAGHU, GANAPATHIRAM	
ART UNIT	**PAPER NUMBER**
1652	

DATE MAILED: 04/07/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/762,769	MELIS ET AL.	
	Examiner	Art Unit	
	Ganapathirama Raghu	1652	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 January 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-9* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *Sep. 14, 2004*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claims 1-31 are pending in this application for examination. Claims 1-9 along with SEQ ID NO: 2 are now under consideration. Claims 10-31 remains withdrawn as they are drawn to non-elected invention.

Election/Restrictions

Applicant's election with traverse of Group I, claims 1-9 along with SEQ ID NO: 2 for prosecution in their response dated 27 Feb. 2006 is acknowledged. The traversal is on the grounds that the search for all claims (1-31) would not be unduly burdensome. Applicants' arguments have been considered, however, Examiner respectfully disagrees and finds them non-persuasive. This is because, in the current application a serious search burden exists to search non-elected groups II-VIII, as the subject matter in said groups consists of specific isolated polynucleotides, genetically modified algae, compositions of algae and bacteria, enzyme assays to detect sulfur uptake, anti-sense oligonucleotides and a method of hydrogen gas generation using algae, photosynthetic and anaerobic bacteria. Polynucleotides and polypeptides are structurally and functionally different products and are subject to separate manufacture and sale. The groups have acquired a separate status in the art and separate fields of search as they belong to separate class and subclass. The search for polynucleotide and polypeptides are not coextensive, would extend to cover all published/pending patent databases, different sequence databases and also non-patent literature and analysis of results. All this will result in a serious search burden. The searches for the disparate subject matter are not coextensive, as it would

involve search of polynucleotide and polypeptide databases, published and pending applications and also non-patent literature and search strategy to include all the limitations in all the claims.

In the previous Office Action, Examiner has already indicated that when applicant elects claims directed to the product, and a product claim is subsequently found allowable, withdrawn process claims that depend from or otherwise include all the limitation of the allowable product claim will be rejoined in accordance with the provisions of M.P.E.P. 821.04. Therefore applicants request to examine claims in all the groups at this time is rendered moot. Applicants at this time have elected a method and therefore the product claims will NOT be rejoined with the elected claims if they are found allowable.

Pursuant to 35 U.S.C. 121 and 37 CFR 1.141 and 37 CFR 1.143 examiner is required to examine one elected polynucleotide or protein sequence, as it is a search burden to examine the entire group. Therefore contrary to applicant's argument, Examiner takes the position that searching all claims in the same application presents a serious search burden for the above-mentioned reasons and the reasons presented in the previous restriction requirement. The requirement is still deemed proper and is therefore made FINAL.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on 14 Sep. 2004 is in compliance with the provisions of 37 CFR 1.97. Accordingly, the examiner is considering the information disclosure statement.

Drawings

Drawings submitted on 01/21/2004 along with the application are accepted for examination purposes only.

Specification

Examiner notes that applicants have not updated the relationship of the instant application to its parent application 10/350298 filed on 01/22/2003 that is copending. Examiner urges applicants to amend said information by providing the relationship of the instant application with that of 10/350298 in response to this office action.

Sequence Compliance

The disclosure is objected to because of the following informalities:

Applicants are required to comply with the sequence rules by inserting the sequence identification numbers of all sequences within the claims and /or specification. It is particularly noted that figures: 8A are sequences, but applicants fail to provide the SEQ ID NO: to these sequences in the figures. See particularly 37 CFR 1.821(d).

Claim Objections

Claims 7-8 are objected to, due to the following informality: The following claims contain abbreviations; Claims 7-8 recite the term "*CrcpSulP*" in the claims. Examiner suggests expanding the first recitation of the abbreviations to recite the full forms of what the abbreviation stands for. Appropriate correction is required.

Claim Rejections: 35 USC § 101

A rejection based on double patenting of the "same invention" type finds its support in the language of 35 U.S.C. 101 which states that "whoever invents or discovers any new and useful process ... may obtain a patent therefor ..." (Emphasis added). Thus, the term "same invention," in this context, means an invention drawn to identical subject matter. See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186 (1894); *In re Ockert*, 245 F.2d 467, 114 USPQ 330 (CCPA 1957); and *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970).

A statutory type (35 U.S.C. 101) double patenting rejection can be overcome by canceling or amending the conflicting claims so they are no longer coextensive in scope. The filing of a terminal disclaimer cannot overcome a double patenting rejection based upon 35 U.S.C. 101.

Claims 1-9 are provisionally rejected under 35 U.S.C. 101 as claiming the same invention as that of claims 1-9 of copending Application No. 10/350298. This is a provisional double patenting rejection since the conflicting claims have not in fact been patented.

Claim Rejections: 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 1 and claims 2-9 depending therefrom are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 1-2 are rejected for the phrase "...is reduced relative to normal wild-type...", as the metes and bounds are not clear. It is not clear to the Examiner as to how much of a reduction is encompassed. Without a numerical value attached to the amount of reduction of expression the above phrase renders the claim indefinite. The scope of the term "is reduced relative to normal" is not clear to the Examiner.

Claims 4 and 8 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 4 and 8 are rejected for the recitation "chosen from", as the metes and bounds are not clear. It is improper Markush language; the correct recitation is "selected from the group consisting of". Clarification is required.

Claims 4 and 5 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 4-5 are rejected for the phrase "...wherein the algae is chosen from *Rhodobacter sphaeroide*...", as the metes and bounds are not clear. It is not clear to the Examiner what is encompassed in the claims as *Rhodobacter sphaeroide* is an anaerobic bacterium and a prokaryote and NOT an alga. Clarification is required.

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 1 and claims 2-3, 6-9 depending therefrom are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Claim 1 is directed to method of hydrogen gas generation by culturing algae under suitable conditions wherein said alga is green algae artificially engineered to reduced expression of sulfate permease gene.

Claims 1-3, 6-9 are rejected under this section 35 U.S.C. 112 because the claim is directed to a method of producing hydrogen gas using a "genus" of algae, that have not been disclosed in the invention. No description of identifying characteristics or structural features recognizing all of the members in the genus has been provided in the specification for the claim. The specification discloses only one species *Chlamydomonas reinhardtii* that can be used for the generation of hydrogen gas. No information regarding all the algae that can be used in method for generating hydrogen gas has been provided by the applicants, which would indicate that they had possession of the claimed genus of algae, or the use of the contemplated algae in the claim for hydrogen gas generation. The specification does not contain any disclosure of the identifying characteristics or structural features recognizing all algae within the scope of the claimed method. The genus of algae to be used for the claimed method is large is a large variable genus including many yet to be discovered organisms which are structurally and physiologically diverse. The disclosed information is insufficient to put one of skill in the art in possession of the attributes and features of all species within the genus for use in the claimed method. Therefore, one skilled in the art cannot reasonably conclude that applicant had possession of the claimed invention at the time the instant application was filed. Applicant is referred to the revised guidelines concerning compliance with the written description requirement of U.S.C. 112, first paragraph, published in the Official Gazette and also available at www.uspto.gov.

Claim 1 and dependent claims 2-9 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for a method of hydrogen gas generation by culturing genetically modified *Chlamydomonas reinhardtii* algae or an anaerobic bacterium *Rhodobacter sphaeroide* under suitable conditions, wherein said algae or bacteria has genetically modified sulfate permease gene, wherein said gene is *CrcpSulP* sulfate permease gene modified by anti-sense technology to reduce the level of said sulfate permease gene by at least 50%, does not reasonably provide enablement for a method of hydrogen gas generation in any algae with any sulfate permease gene is being genetically altered by any method. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to use the invention commensurate in scope with these claims.

Factors to be considered in determining whether undue experimentation is required are summarized in *In re Wands* (858 F.2d 731, 8 USPQ 2nd 1400 (Fed. Cir. 1988)) as follows: (1) the quantity of experimentation necessary, (2) the amount of direction or guidance presented, (3) the presence or absence of working examples, (4) the nature of the invention, (5) the state of the prior art, (6) the relative skill of those in the art, (7) the predictability or unpredictability of the art, and (8) the breadth of the claim(s).

Claims 1-9 are so broad as to encompass methods of hydrogen gas generation using any algae wherein any sulfate permease gene is genetically altered by any method. The scope of the claim is not commensurate with the enablement provided by the disclosure with regard to a method of hydrogen gas generation that encompasses extremely large number of algae, polynucleotides, polypeptides and methods for artificially engineering to reduce the level of any sulfate permease gene broadly included in the claim. Since the amino acid sequence of a protein

encoded by a polynucleotide determines its structural and functional properties, predictability of which changes can be made or successfully employ the correct method to achieve the desired reduction in levels of sulfate permease gene activity requires detailed knowledge of the ways in which the encoded proteins' structure relates to its function and detailed sequence information and also the species of algae i.e., cellular context. However, in this case the disclosure is limited to the use of single green alga *Chlamydomonas reinhardtii* in which *CrcpSulP* polypeptide sequence of SEQ ID NO: 2 encoded by the genomic sequence (polynucleotide) of SEQ ID NO: 1 is modified by an anti-sense oligonucleotide sequence that hybridizes to a portion of polynucleotide encoding the polypeptide sequence of SEQ ID NO: 2. It would require undue experimentation of the skilled artisan to make the same in any alga in order to generate hydrogen gas. The specification is limited to teaching the method of hydrogen gas generation by genetically modifying the expression of SEQ ID NO: 1 which encodes SEQ ID NO: 2, having sulfate permease activity specifically in *Chlamydomonas reinhardtii*, but provides no guidance with regard to the making the same in any other algae. It is well known in the art that algae comprise a large group of organisms from microscopic to macroscopic with highly different kinds of metabolic activity. Applicants have not shown that the method claimed works in all or any algae including those that may or may not comprise a sulfate permease. Furthermore, since there could be more than one sulfate permeate gene in any given algae, applicants have provided no guidance as to which specific sulfate permease need to be targeted. In view of the great breadth of the claims, amount of experimentation required to use any or all algae, the claimed invention would require undue experimentation.

While gene identification and isolation techniques are known, and it is routine in the art to screen for organisms to identify homologs and orthologs of sulfate permease gene by employing different methods as encompassed by the instant claim, the isolation of specific green alga that can be utilized for the generation of hydrogen gas production by the modification of sulfate permease gene with a reasonable expectation of success are limited and the result of such use is unpredictable, as the alga may not tolerate such a modification and the viability of the organism may be affected.

The specification does not support the broad scope of the claims which encompass a method of hydrogen gas generation in any algae with any sulfate permease gene genetically altered by any method because the specification does not establish: (A) universal method to reduce sulfate permease activity in any algae; (B) a rational and predictable scheme for using any or all algae for production of hydrogen gas by reducing the gene activity of any sulfate permease in said algae; and (C) the specification provides insufficient guidance as to which of the essentially infinite possible choices is likely to be successful.

Thus, applicants have not provided sufficient guidance to enable one of ordinary skill in the art to make and use the claimed invention in a manner reasonably correlated with the scope of the claims broadly including any or algae, in which any or all sulfate permease activity is reduced. The scope of the claims must bear a reasonable correlation with the scope of enablement (*In re Fisher*, 166 USPQ 19 24 (CCPA 1970)). Without sufficient guidance, determination of algae having the desired biological characteristics is unpredictable and the experimentation left to those skilled in the art is unnecessarily, and improperly, extensive and undue. See *In re Wands* 858 F.2d 731, 8 USPQ2nd 1400 (Fed. Cir, 1988).

Claim Rejections 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Miura et al., (US Patent: 4,532, 210, issued Jul. 30, 1985), Allen et al., (US Patent: 6,696,292 B1, issued Feb. 24, 2004) and Ghirardi et al., (TIBTECH Vol.18: 506-511, 2000). Claims 1-8 are directed to a method of a method of hydrogen gas generation by culturing algae under suitable conditions, wherein sulfate permease expression of the algae is reduced relative to normal wild type, wherein said algae is selected from *Rhodobacter sphaeroide* or *Chlamydomonas reinhardtii* algae, wherein said gene is *CrcpSulP* sulfate permease gene modified by anti-sense technology to reduce the expression level of said sulfate permease gene.

First prior art Miura et al., (*supra*) teaches the method/process for producing hydrogen by culturing alga, *Chlamydomonas reinhardtii* under suitable conditions of illumination and microaerobic environment (page 1 Abstract section). However said reference is silent on the use of modifying/reducing the levels of sulfate permease gene in an alga.

Second prior art Allen et al., (*supra*) teaches the isolation of polynucleotides encoding the proteins for sulfate assimilation including sulfate permease gene, construction of a chimeric gene encoding all or a portion of the sulfate assimilation protein in sense or antisense orientation, wherein expression of the chimeric gene results in production of altered levels of the sulfate assimilation protein in a transformed cell, especially in applications where an altered phenotype is desired (page 1 Abstract section; antisense or cosuppression technologies to reduce expression of particular genes, line 45-48, column 10, Example 6, expression of chimeric genes in microbial cells, column 19 and 20).

Third prior art Ghirardi et al., (*supra*) teach the approaches that are being developed for algal hydrogen production, especially two-stage photosynthesis and hydrogen gas production in green algae. The reference teaches that when *Chlamydomonas reinhardtii* cultures are grown under conditions of anaerobiosis and sulfur deprivation they produce more hydrogen gas (page 506, column 2, last paragraph; Figure 4 and column 2, page 508). The cited reference states "sulfur deprivation might be the key with which to alter the dynamic relationship between cellular processes of oxygenic photosynthesis, aerobic respiration, chlororespiration and hydrogen photoproduction". Furthermore, the reference also suggests that the combined application of selection and breeding by classical genetics and recombinant DNA technology, one would be able to increase hydrogen productivity in green algae.

Combining the teachings of the above three references, it would have been obvious to those skilled in the art at the time of the instant invention to develop a method of hydrogen gas generation by modifying or altering the levels of sulfate permease activity in green algae as this would result in diminished uptake of sulfur in modified algae, which in turn would stimulate the metabolic machinery to produce more hydrogen gas under suitable conditions of growth such as anaerobiosis.

One of ordinary skill in the art would be motivated to do so since sustained hydrogen gas production through biosource is desirable as a clean energy source and is presently the focus of interest in the energy producing industry sector. The reference of Miura et al et al., and Ghirardi et al., establishes the conditions for growth of green algae and the role of sulfate permease gene in hydrogen gas production. The reference of Allen et al., teach the methods of altering the activity of sulfate permease genes through antisense cosuppresion technology. One of ordinary skill in the art would have had a reasonable expectation of success, because of the clear establishment of the growth conditions such as illumination and anaerobiosis by Miura et al et al, and the role of sulfate permease is elucidated by Ghirardi et al., and finally provision of methods to alter the activity of sulfate permease gene by Allen et al., to generate cells with reduced activity of sulfate permease gene.

Therefore, the above references render Claim 1-8 *prima facie* obvious to one of ordinary skill in the art.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Miura et al., (US Patent: 4,532, 210, issued Jul. 30, 1985), Allen et al., (US Patent: 6,696,292 B1, issued Feb. 24, 2004) and Ghirardi et al., (TIBTECH Vol.18: 506-511, 2000) as applied to claims 1-8 above, and further in view of Laudenbach et al., (J. Bacteriol., 173 (9): 2739-2750, 1991). Claim 9 is drawn to a method wherein the algae is genetically modified by insertion of an antisense sequence to *CrcSulP* gene or sense strand of *CrcSulP* gene, wherein the antisense sequence hybridizes to a portion of SEQ ID NO: 2. Laudenbach et al., disclose a polynucleotide sequence of an algal sulfate permease gene wherein, said sequence can be used to generate antisense oligonucleotides to a portion of SEQ ID NO: 2 herein (see enclosed sequence alignments).

Combining the teachings of the above cited references, it would have been obvious to those skilled in the art at the time of the instant invention to develop a method of down regulating the expression levels of sulfate permease gene in *Chlamydomonas reinhardtii* using the sequences provided by Laudenbach et al., to increase the hydrogen gas production in said alga. One of ordinary skill in the art would be motivated to do so since, the reference of Miura et al., (*supra)* teaches the method/process for producing hydrogen by culturing alga, *Chlamydomonas reinhardtii* under suitable conditions of illumination and microaerobic environment. Ghirardi et al., (*supra*) teaches the approaches that are being developed for algal hydrogen production, especially two-stage photosynthesis and hydrogen gas production in green algae, that when *Chlamydomonas reinhardtii* cultures are grown under conditions of anaerobiosis and sulfur deprivation they produce more hydrogen gas. Allen et al., (*supra*) teaches reducing the expression of sulfate permease using antisense technique. Laudenbach et al, teaches a polynucleotide sequence of an algal sulfate permease gene, said sequence can be used to

generate antisense oligonucleotides to a portion of SEQ ID NO: 2 either for disrupting the gene or for isolating and further engineering the *Chlamydomonas reinhardtii* sulfate permease by employing them as probes. One of ordinary skill in the art would have a reasonable expectation of success, because of the clear establishment of the fact by Ghirardi et al., (*supra*) that the production of hydrogen gas production in green algae can be increased by depriving sulfate, i.e., sulfate permease activity. The reference also teaches that when *Chlamydomonas reinhardtii* cultures are grown under conditions of anaerobiosis and sulfur deprivation they produce more hydrogen gas. The cited reference states "sulfur deprivation is the key with which to alter the dynamic relationship between cellular processes of oxygenic photosynthesis, aerobic respiration, chlororespiration and hydrogen photoproduction". Furthermore, the reference also suggests that the combined application of selection and breeding by classical genetics and recombinant DNA technology, one would be able to increase hydrogen productivity in green algae.

Therefore, the above references render Claim 9 depending therefrom *prima facie* obvious to one of ordinary skill in the art.

Conclusion

None of the claims are allowable.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ganapathirama Raghu whose telephone number is 571-272-4533. The examiner can normally be reached on 8 am - 5 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ponnathapu Achutamurthy can be reached

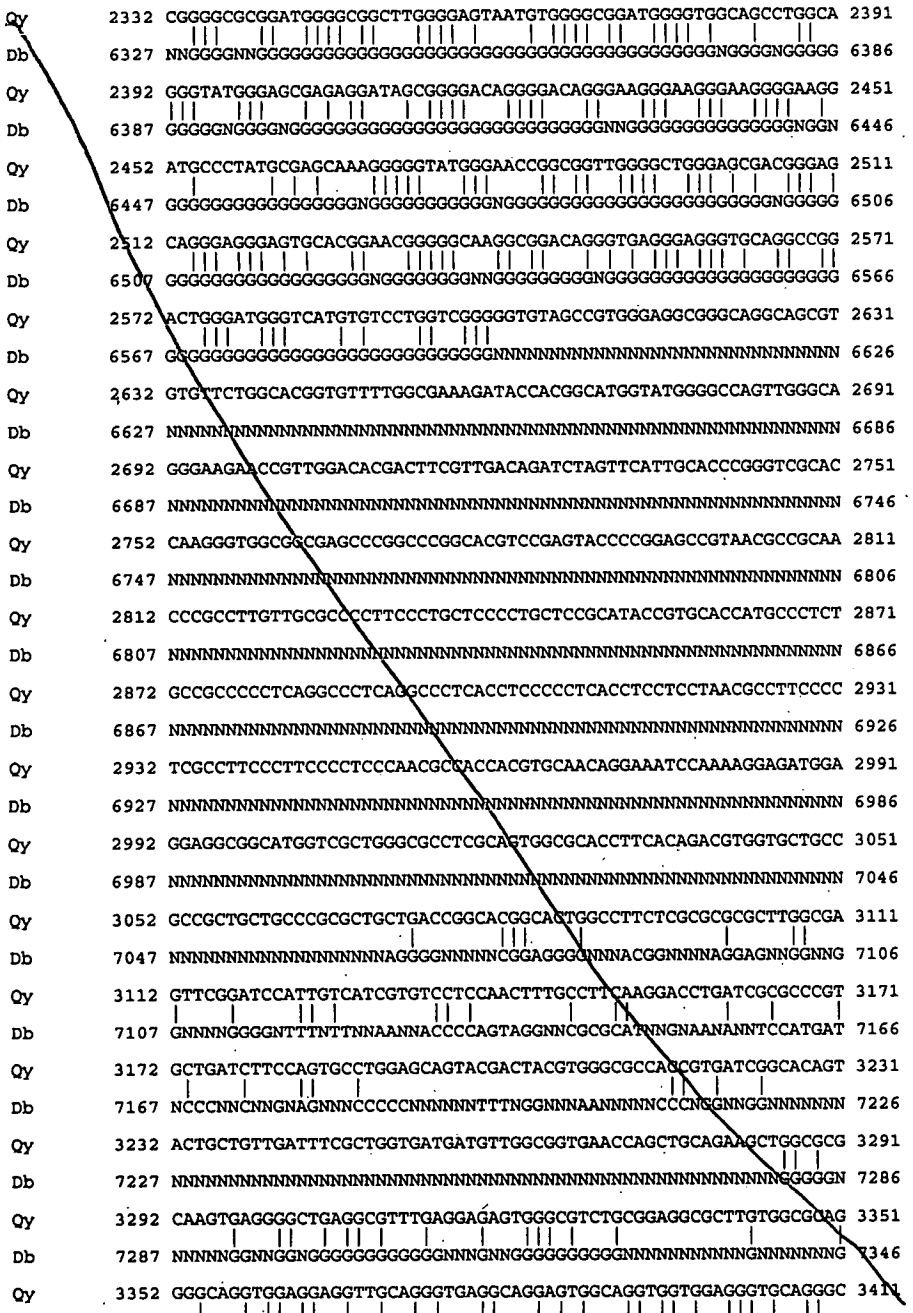
on 571-272-0928. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300 for regular communications and for After Final communications. Any inquiry of a general nature or relating to the status of the application or proceeding should be directed to the receptionist whose telephone number is 571-272-1600.

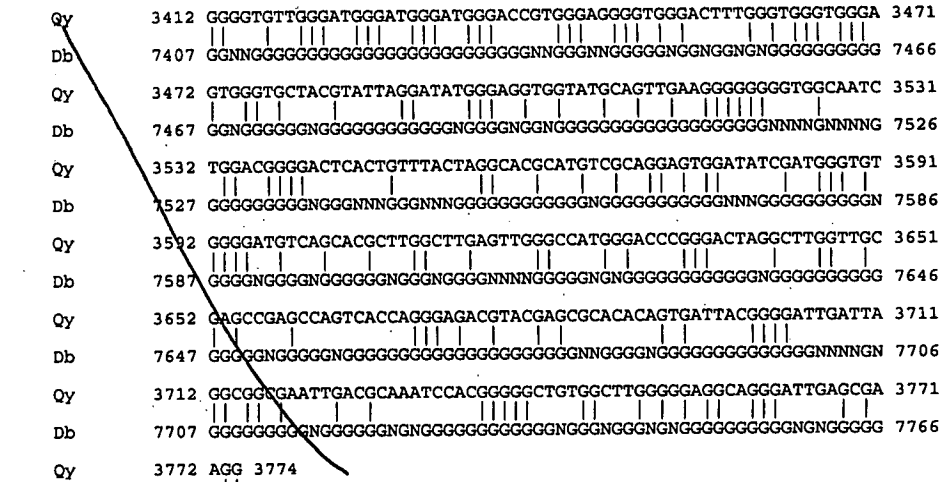
Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Ganapathirama Raghu, Ph.D.
Patent Examiner
Art Unit 1652

March 22, 2006.

MANJUNATH N. RAO, PH.D.
PRIMARY EXAMINER





```
RESULT 9
SYOCYS
LOCUS       SYOCYS                  4127 bp    DNA     linear   BCT 21-MAR-2000
DEFINITION  Synechococcus PCC7942 strain PCC 7942 homologous to nucleotide
            binding polypeptides of other permease systems; putative (cysA)
            gene, partial cds; sbpA (sbpA), integral membrane polypeptide of
            the sulfate permease (cysT), cysR (cysR), and integral membrane
            polypeptide of the sulfate permease (cysW) genes, complete cds; and
            unknown gene.
ACCESSION   M65247
VERSION     M65247.1  GI:154505
KEYWORDS    sulfate permease.
SOURCE      Synechococcus elongatus PCC 7942
  ORGANISM  Synechococcus elongatus PCC 7942
            Bacteria; Cyanobacteria; Chroococcales; Synechococcus.
REFERENCE   1  (bases 1 to 4127)
  AUTHORS   Laudenbach,D.E. and Grossman,A.R.
  TITLE     Characterization and mutagenesis of sulfur-regulated genes in a
            cyanobacterium: evidence for function in sulfate transport
  JOURNAL   J. Bacteriol. 173 (9), 2739-2750 (1991)
   PUBMED   1708375
FEATURES             Location/Qualifiers
     source          1. .4127
                     /organism="Synechococcus elongatus PCC 7942"
                     /mol_type="genomic DNA"
                     /strain="PCC 7942"
                     /db_xref="taxon:1140"
     gene            complement(1. .33)
                     /gene="cysA"
     CDS             complement(<1. .33)
                     /gene="cysA"
                     /note="homologous to nucleotide binding polypeptides of
                     other permease systems; putative"
                     /codon_start=1
                     /transl_table=11
                     /protein_id="AAA73042.2"
                     /db_xref="GI:7272368"
                     /translation="MPKDKAVGIQV"
     gene            233. .1285
                     /gene="sbpA"
     CDS             233. .1285
                     /gene="sbpA"
                     /function="sulfate-binding protein"
                     /codon_start=1
```

```
                     /transl_table=11
                     /protein_id="AAA73043.1"
                     /db_xref="GI:154507"
                     /translation="MKTAWTRRSFLQSAALATATVITIAACGGNNQSSSGGSGQPVEV
                     TLVSYAVTQAAYEQIIPKFAAQWKEKTGQEVRFNQSYGGSGSQTRAVIDGLEADVVAL
                     ALESDINQIEKAGLIQPGWQQRVPNNGIITNSVVALVTQEGNPKGIKDWTDLTKPGVR
                     IVTANPKTSGGARWNFLGAWGSVTQTGGTEEQALQFTTDIYKNVPILAKDARESTDVF
                     TKGQADVLLNYENELILAQQKGEKVDYAIPPVNINIQGPVAVVDTYTDKHGTRKVSEA
                     FVQFLFTPEAQAEFAKVGFRPALPEGVDPQLLAPFPKIQTWFTVADLGGWAKVQPEFF
                     GDGGWFDKVQQAVAGR"
     gene            1360. .2196
                     /gene="cysT"
     CDS             1360. .2196
                     /gene="cysT"
                     /note="integral membrane polypeptide of the sulfate
                     permease"
                     /codon_start=1
                     /transl_table=11
                     /protein_id="AAA73044.1"
                     /db_xref="GI:154508"
                     /translation="MSLRLPSLSFTWLTRLSWSWRFTWVYLTLILFIPIIALFLKSAS
                     LPLGRIWELATQPVAVAAYEVTFGLSLAAAALNGVFGVIIAWVLTRYDFPGKKLFDSF
                     IDLPFALPTAVAGLTLATVYSDKGWIGQFIAPFGVQIAFTRWGVLLAMVFISLPFVVR
                     TVEPLLLELEVEAEEAAASLGASPSETFWRVILPPILPGVLAGVAQGFSRAVGEFGSV
                     VIISGNLPFDDLIAPVLIFERLEQYDYAGATVIGSVLLLFSLVILFVINALQNWSSRY
                     NG"
     CDS             2220. .2465
                     /codon_start=1
                     /transl_table=11
                     /label=orf81
                     /product="unknown"
                     /protein_id="AAA73045.1"
                     /db_xref="GI:154509"
                     /translation="MATLRIRLQVPKKYRDQPLMGDVLASCQLQFNILAAHLGPNREE
                     DGWFDVMLTGTSEDITAALAVLRDRDIELWSDTEDEF"
     gene            2493. .3113
                     /gene="cysR"
     CDS             2493. .3113
                     /gene="cysR"
                     /codon_start=1
                     /transl_table=11
                     /protein_id="AAA73046.1"
                     /db_xref="GI:154510"
                     /translation="MVREPASTLLPPTSPATPAPHRLLIGRRGMVPTGANVIWKIQSG
                     LVRSSTWGEEGDMISLGLWGPGDLIGRPLSCLDPYELECLTAVEVVAVSDPALESHES
                     LVRSLRYTERLLSITRLRRAEAKLASLLGWIGERFGQPGATGWEIDLRRIPLTHQVIA
                     ELSGSTRVTTTRLLGEFRQAGRIHRRDRALIVRYPETLYPPARLSA"
     gene            3159. .4019
                     /gene="cysW"
     CDS             3159. .4019
                     /gene="cysW"
                     /note="integral membrane polypeptide of the sulfate
                     permease"
                     /codon_start=1
                     /transl_table=11
                     /protein_id="AAA73047.1"
                     /db_xref="GI:154511"
                     /translation="MVAFVKARRQIAGVKESKSLLPLALIGISLLYVGLIIIIPAANV
                     AVQAFSEGLSGFIKNLGDRNLQEAIRLTLLMGVISVPLNTLFGLAAAFAIARKQFPGK
                     SLLLSVIDLPFSISPVVAGLMIVLLYGRNGWLGPLLESNDIKIIFAWPGMALATIFVS
                     MPFVAREVIPNLEEIGTDAEEAASTLGANGWQTFWRVTLPSIKWSMLYGVVLTTARAL
                     GEFGAVSVVSGSITGKTQTLPLFVEEAYKQYQTTLSYTAALLLGGISLVTLVLKALLE
                     ARTGRQSRIH"
ORIGIN

  Query Match             3.9%;  Score 152.6;  DB 1;  Length 4127;
  Best Local Similarity   67.4%;  Pred. No. 1.6e-09;
  Matches  215;  Conservative    0;  Mismatches  104;  Indels    0;  Gaps    0;

Qy       2964 TGCAACAGGAAATCCAAAAGGAGATGGAGGAGGCGGCATGGTCGCTGGGCGCCTCGCAGT 3023
             ||| |||| | | ||| || || ||||| || ||||| || | |
Db       1853 TGCTGTTGGAACTGGAGGTGGAAGCAGAAGAAGCGGCCGCTTCCCTGGGGGCTAGCCCCA 1912

Qy       3024 GGCGCACCTTCACAGACGTGGTGCTGCCGCCGCTGCTGCCCCGCGCTGCTGACCGGCACGG 3083
             | |||||       ||| | | |||||| | || |||| | ||||| |||||   |
Db       1913 GTGAAACCTTTTGGCGCGTCATCTTACCGCCGATTCTCCCCGGGGTGCTGGCCGGCGTTG 1972

Qy       3084 CACTGGCCTTCTCGCGCGCGCTTGGCGAGTTCGGATCCATTGTCATCGTGTCCTCCAACT 3143
             | | ||  |||||||| ||  |||||||||| || ||  | || ||| | ||    ||||
Db       1973 CCCAGGGTTTCTCGCGAGCCGTTGGCGAGTTTGGTTCGGTGGTGATCATCTCGGGTAACT 2032

Qy       3144 TTGCCTTCAAGGACCTGATCGCGCCCGTGCTGATCTTCCAGTGCCTGGAGCAGTACGACT 3203
             | ||||| | ||| |||| ||||| || ||||| ||| |  | ||||| ||||||||||
Db       2033 TGCCCTTCGATGACTTGATTGCGCCGGTTCTGATTTTCGAACGACTGGAACAGTACGACT 2092

Qy       3204 ACGTGGGCGCCACCGTGATCGGCACAGTACTGCTGTTGATTTCGCTGGTGATGATGTTGG 3263
             ||| |||||||||||||||| ||| | ||  ||||| || |||| ||||||||  |||| |
Db       2093 ACGCGGGCGCCACCGTGATTGGCTCCGTCTTGCTGCTGTTTTCACTGGTGATTCTGTTCG 2152

Qy       3264 CGGTGAACCAGCTGCAGAA 3282
              | | |||  ||| |||||
Db       2153 TGATCAACGCGCTCCAGAA 2171


RESULT 10
AP008231_25/c
WPCOMMENT
  Sequence split into 27 fragments  LOCUS AP008231 Accession AP008231
     Fragment Name      Begin     End
     AP008231_00            1    110000
     AP008231_01       100001    210000
     AP008231_02       200001    310000
     AP008231_03       300001    410000
     AP008231_04       400001    510000
     AP008231_05       500001    610000
     AP008231_06       600001    710000
     AP008231_07       700001    810000
     AP008231_08       800001    910000
     AP008231_09       900001   1010000
     AP008231_10      1000001   1110000
     AP008231_11      1100001   1210000
     AP008231_12      1200001   1310000
     AP008231_13      1300001   1410000
     AP008231_14      1400001   1510000
     AP008231_15      1500001   1610000
     AP008231_16      1600001   1710000
     AP008231_17      1700001   1810000
     AP008231_18      1800001   1910000
     AP008231_19      1900001   2010000
     AP008231_20      2000001   2110000
     AP008231_21      2100001   2210000
     AP008231_22      2200001   2310000
     AP008231_23      2300001   2410000
     AP008231_24      2400001   2510000
     AP008231_25      2500001   2610000
     AP008231_26      2600001   2696255
Continuation (26 of 27) of AP008231 from base 2500001 (AP008231 Synechococcus elongatus

  Query Match             3.9%;  Score 151;  DB 1;  Length 110000;
  Best Local Similarity   67.1%;  Pred. No. 9.8e-10;
  Matches  214;  Conservative    0;  Mismatches  105;  Indels    0;  Gaps    0;

Qy       2964 TGCAACAGGAAATCCAAAAGGAGATGGAGGAGGCGGCATGGTCGCTGGGCGCCTCGCAGT 3023
             |||   |||| | |  |||    || || |||||  || ||||| ||    |
Db      66354 TGCTGTTGGAACTGGAGGTGGAAGCAGAAGAAGCGGCCGCTTCCCTGGGGGCTAGCCCCA 66295

Qy       3024 GGCGCACCTTCACAGACGTGGTGCTGCCGCCGCTGCTGCCCCGCGCTGCTGACCGGCACGG 3083
             | |||||       ||| | | |||||| | || |||| | ||||| |||||   |
Db      66294 GTGAAACCTTTTGGCGCGTCATCTTACCGCCGATTCTCCCCGGGGTGCTGGCCGGCGTTG 66235

Qy       3084 CACTGGCCTTCTCGCGCGCGCTTGGCGAGTTCGGATCCATTGTCATCGTGTCCTCCAACT 3143
             | | ||  |||||||| ||  |||||||||| || ||  | || ||| | ||    ||||
Db      66234 CCCAGGGTTTCTCGCGAGCCGTTGGCGAGTTTGGTTCGGTGGTGATCATCTCGGGTAACT 66175

Qy       3144 TTGCCTTCAAGGACCTGATCGCGCCCGTGCTGATCTTCCAGTGCCTGGAGCAGTACGACT 3203
             | ||||| | ||| |||| ||||| || ||||| ||| |  | ||||| ||||||||||
```